When the waters again fell and withdrew to a lower level, the present Lake Okeechobee came into existence. Lowering of the water table exposed a narrow zone of sedimentary mud flats on the south shore of the lake, and was accompanied by the rapid invasion of deciduous broad-leaved trees and shrubs. A dense growth of custard apple trees (*Anona glabra*) became dominant and formed a forest in which other tree-like vegetation was scant. Many of the older trees had enlarged bases induced by the influence of submergence in water. The location and width of the "custard-apple belt," previous to its destruction coincident with drainage and cultural operations, are shown on the phytogeographic map published by Harshberger (11).

A comparison of the peat profiles in the "custard-apple belt" between the shore of the Lake and the interior of the Everglades suggests more differences than correspondences in the upper and recent layer of peat. The disagreement, however, is essentially due to fluctuation in water level. Woody peat is lacking entirely. Readvances of the shore line are marked by readvances in aquatic vegetation and corresponding deposition of sedimentary peat; periods, short in duration, of lower water supply are correlated by the development of saw-grass vegetation and herbaceous plants which were favored and pushed forward over the exposed mudflats. Some of the bands of shell marl below laminated, platy, yellowish-brown, fibrous peat derived from *Pontederia* and semiaquatic members of the *Naiadales* and *Arales* surely record a wide re-entrance of saw-grass vegetation over sedimentary peat, and a corresponding drainage of the lake and of the Everglades. The extent and the number of oscillations in water level seem to have been small, for the bands are disturbed and alternate irregularly at several localities. Although thin layers of fibrous and herbaceous sedge peat extend beyond the present lake margin, they have only moderate thickness and indicate effects of an unstable shore line. This supposition is strongly supported also by the fact that in the interior of the Everglades and in the bays of Lake Okeechobee the corresponding layers of sedge peat record more uniform conditions. As already noted in another connection (4) they suggest that during the last few thousand years there has been no major differential submergence and no appreciable change in the relative positions of water level. The evidence indicates that custard-apple hammocks established themselves only recently upon the mud flats along Lake Okeechobee, and the record of the peat profiles leads toward the conclusion of an essentially stable coastal plain in historic time.

A ridge of fine silicious sand occupies the northeast and east shores of Lake Okeechobee. The sand ridge at Canal Point is about six feet high, varies in width from about 25 to 200 feet and rests on sedimentary peat along the entire southeastern shore of the lake. Prior to drainage operations it was clothed with bald cypress (*Taxodium distichum*), maple (*Acer carolinianum*), ash (*Fraxinus caroliniana*), holly (*Ilex cassine*), strangling fig (*Ficus aurea*), palmetto (*Sabal palmetto*), many shrubs, and herbaceous undergrowth; the stand was almost impenetrable in many places. These low dune-like ridges and mounds of sand are not directly related to the present shore line, although they occur near the shore of Lake Okeechobee and are not found inland on the saw-grass peat of the Everglades. From their position they may be in part the work of winds and in part due to wave action, particularly southward-setting currents; they were probably formed more or less recently, but at a time when water level conditions favored sand drift.

The present vegetation of the Everglades has been described in great detail by Harshberger (11). Consultation of the phytogeographic map which accompanies his monograph will show the limits of the saw-grass vegetation and diverse plant communities, but not of the actual accumulation of saw-grass peat. Harper (10) has listed the constituent plants of the principal types of vegetation and has given many sources of information in his bibliography. To complete the picture it is necessary to keep in mind that broad-leaved shrubs and trees belonging to types essentially southern in range and characteristic of the belt of cypress-tupelo-red gum swamps have been invading the Everglades only recently. As yet layers of woody peat derived from them are lacking. In the interior of the Everglades are scattered hammocks or islands of hardwood trees and shrubs with vines, ferns, and epiphytes. Where fires do not suppress it, this group of vegetation is displacing the saw-grass more or less rapidly. In a not-distant future hammock vegetation will be typical where the saw-grass is still in evidence.

CONCLUSIONS AND NEW PROBLEMS

In the present paper the primary object has been to treat in a preliminary fashion the general origin and nature of the upper portion of that large stretch of sedge moor, the Everglades of Florida, one of the largest subtropical peat areas in the world, extending from Lake Okeechobee to the Gulf of Mexico.

Three distinct but genetically related series of peat profiles are pointed out. (1) the area of profiles in and bordering Lake Okeechobee; (2) the area of profiles in the main interior portion of the Everglades; (3) the area of peat profiles bordering the highland. The general relations of these three series of profiles to each other are shown diagrammatically in Figs. 2 to 7. The morphological features and botanical composition which characterize representative soundings of each of these series of profiles have been described and the effects of oscillations of water level upon the stratigraphic origin and form of the profiles were considered. It is concluded that the salient features of the Everglades do not find an explanation in the geologic structure, or in the configuration of the bedrock as an inland lake; the peat profiles show a remarkable dependence upon inundations and oscillations of water level and corresponding changes in shore line during a time relatively recent. The Upper Everglades of Florida present the aspects of a eutrophic sedge moor characterized by series of one-, two-, and three-layered telmatogenic profiles.

A number of special problems possess more than ordinary interest. It is in the wide bearing not only on practical agriculture but also on fields of science, particularly Pleistocene geology, geography, botany, climatology and even archaeology that their scientific value and importance are to be found.

If a sufficient number of profile measurements can be secured together with their elevations above sea level, the successive positions of ancient Lake Okeechobee, the several stages and forms of the receding and advancing shore line can be mapped. It is hoped that such a valuable list of accurate measurements as that obtained through the coöperation with the Everglades State Drainage office will be made for a large number of points along lines of traverse in an east-west and north-south direction. They have a high scientific and practical value. There is a scarcity of trustworthy data for solving certain difficult problems in regional peat investigations, or on which to base reliable estimates of the rate and amount of shrinkage and decomposition of peat deposits under different climatic conditions and agricultural practices.

A closer treatment requires also biochemical analyses of the profile series, including the mechanical and chemical character of both the shore peat (littoral *gyttja*) and lake peat (limnic *gyttja*) as geographical types of sedimentary peat. Of considerable interest should be detailed quantitative and stratigraphic studies of pollen and other plant remains in the succession of peat layers.

It would be pertinent also to inquire into the causes of the inundations to which the region has been subject and which determined the primary characteristics of the Everglades peat soils. Determination of the extent, number, and duration of the overflows and changes in water level, the amount of fall and rise recorded by the peat profiles, should be of great interest in problems connected with the control of intermittent, impounded surface waters. The factors that caused longstanding high-water-level conditions and changes in the shore of Lake Okeechobee are yet to be determined. The theory of relatively recent oscillations of the coast, involving both emergence and subsidence of the Floridian mainland, is apparently disproved by the character of the Everglades peat layers and the absence of tidal-marsh peat.

An estimate of the length of time required for the formation of this interesting peat region with its flooded and ponded lake and shifting, complicated shore lines should be another aim in studies like this, especially if correlated with contemporaneous periods in the ice retreat in North America. Correlation tables already published (3) are only a beginning of the task of constructing a continuous record. The complexity and difficulty of the whole problem of possible changes of level requires contributions from different aspects, and the light of fuller knowledge than now at our command. Particular attention should be given to comparisons with northern coastal regions serving to clarify the relationship between stratigraphic features and environmental changes.

Studies to correlate the effects of drainage and of special chemical salts, applied to promote the growth of crops, are under way on fields representing each profile series.

REFERENCES

(1) Allison, R. V., Bryan, O. C., and Hunter, J. H. *The stimulation of plant response on the raw peat soils of the Florida Everglades through the use of copper sulphate and other chemicals.* Univ. Florida Agric. Exp. Sta. Bull. 190. 1927.

(2) Baldwin, M. and Hawker, H. W. *Soil Survey of the Fort Lauderdale area, Florida.* Field Operations, U. S. Bureau of Soils, 1919.

(3) Dachnowski, A. P. *The correlation of time units and climatic changes in peat deposits of the United States and Europe.* Proc. Nat. Acad. Sci. **8**: 225–231. 1922.

(4) Dachnowski-Stokes, A. P., and Allison, R. V. *A preliminary note on blue-green algal marl in southern Florida in relation to the problem of coastal subsidence.* This Journal **18**: 476–480. 1928.

(5) Dachnowski-Stokes, A. P. *The botanical composition and morphological features of "highmoor" peat profiles in Maine.* Soil Sci. **27**: 379–388. 1929.

(6) Elliot, F. C. Bienn. Rept. Everglades Drainage District, Tallahassee, Florida. 1925–1926.

(7) *Everglades of Florida.* U. S. Senate Doc. 89, 62nd Congress, 1st Session, Washington, D. C. 1911.
(8) *Florida Everglades.* U. S. Senate Doc. 379, 63d Congress, 2nd Session, Washington, D. C. 1914.
(9) FORSAITH, C. C. *Report on some allocthonous peat deposite of Florida.* Bot. Gaz. **62**: 32–52, 1916, **63**: 190–208. 1917.
(10) HARPER, R. M. *Natural resources of Southern Florida.* Eighteenth Ann. Rep. Fla. State Geol. Survey, 27–206. 1927.
(11) HARSHBERGER, J. W. *The vegetation of South Florida, south of 27°30′ north, exclusive of the Florida Keys.* Trans. Wagner Free Inst. Sci. 7: 49–189. 1914.
(12) LUNDQUIST, G. *Methoden zur Untersuchung der Entwicklungsgeschichte der Seen.* Abderhalden's Handbuch der biologischen Arbeitsmethoden. Abt. 9, T. 2, (fig. 173), 427–462. 1925.
(13) MATSON, G. C., and SANFORD, S., *Geology and ground waters of Florida.* U. S. Geol. Survey, Water Supply Paper 319. 1913.

ZOOLOGY.—*Descriptions of two new amphipod crustaceans (Talitridae) from the United States.*[1] CLARENCE R. SHOEMAKER, United States National Museum. (Communicated by MARY J. RATHBUN.)

While sorting a small collection of crustacea which was sent to the U. S. National Museum for identification by the U. S. Biological Survey in May, 1929, I noticed a species of *Orchestia* which was new to science. The specimens, one male and two females, were collected by Mr. F. M. Uhler, and in answer to my inquiry as to the exact locality, he says in his letter, "The specimens were taken on the north side of a small lake or pond located on the northwest side of Lake Monroe, and were found under a board on a rather sandy gently sloping margin, 2–4 yards from the water's edge. This spot apparently is in Volusia County, Florida, very close to the Seminole County line, and Sanford is the nearest town of any importance. This pond is located about 1–1½ miles from the bridge across the outlet of Lake Monroe, and is separated from the lake only by a strip of semi-dry marsh covered with vegetation. The water of the pond is supplied by a large sulphur spring, a sulphurous artesian well, and by high water from the main body of Lake Monroe. Lake Monroe is merely a broadened portion of the St. Johns River, and although the water apparently is fresh, it contains such marine vertebrates as the sting ray (*Dasyatis sabina*) which frequently enters fresh water."

I have designated this new species *Orchestia uhleri* in honor of its discoverer.

[1] Received February 7, 1930.

In 1905, Dr. James E. Benedict took some specimens of an *Orchestoidea* at Pacific Grove, California, which upon examination proved to be a new species. Mr. E. M. Chase collected further examples of this species on April 27, 1918 at Anaheim Bay, Seal Beach, California. Dr. Waldo L. Schmitt, during his investigations of spiny lobsters, procured additional material from kelp hold-fasts on the beach at La Jolla, California. Mr. Frank F. Gander has presented the National Museum with specimens which he took in 1927 at San Diego, California. Mr. Gander states that he took this species both in the littoral marine and at Balboa Park, which affords another example of a member of the family *Talitridae* extending from the coast to a considerable distance inland.

This species I have named *Orchestoidea benedicti* in honor of its discoverer.

Orchestia uhleri, n. sp.

Figures 1 and 2

Type-locality.—Near Lake Monroe, Volusia County, Florida, collected by F. M. Uhler, March 22, 1928; 1 male holotype (Cat. No. 62956, U. S. N. M.).

Male.—Eyes black, round, and of moderate size. Antenna 1 extending slightly beyond the fourth joint of antenna 2, flagellum composed of four joints and slightly longer than peduncle. Antenna 2 very nearly as long as the head and first four body segments, fourth joint of peduncle about three-fourths the length of fifth, flagellum composed of thirteen joints and as long as the fourth and fifth joints of peduncle combined. Mandible, cutting edge rather narrow and oblique and armed with two large and three smaller teeth, secondary plate well developed, two stout plumose spines and one or two smaller ones in spine-row, molar large and strong, bearing many transverse ridges on its slightly concave surface, and having at its base near the spine-row a dense brush of plumose setae. Maxilla 1, inner plate long and narrow and bearing on its distal end three plumose spines, outer plate bearing 9 serrate spine-teeth, palp very small with second joint about one-third the length of first. Maxilla 2, inner plate very nearly as long as outer and bearing on its obliquely truncated extremity many plumose spines and setae, outer plate evenly rounded distally and bearing many curved spines. Maxillipeds, inner plates reaching very nearly to the end of the first joint of palp, broadened distally, and bearing four short spine-teeth on their truncated ends, outer plates short and broad, reaching about one-third the distance along the second joint of palp, palp very short and broad, all the joints being wider than long. Lower-lip about normal. Gnathopod 1, side-plate very slightly concave in front and evenly rounded below, fourth joint with shallow lobe on lower margin, fifth with prominent lobe on lower margin, sixth joint about two-thirds the length of fifth, lower margin produced distally into a soft tumid lobe, palm short, transverse and armed with a row of long slender spines, seventh joint as long as palm, bearing about one-third the distance from the apex several slender setae, and armed on inner edge with three short blunt spines. Gnathopod 2 large and powerful, second joint four-fifths as

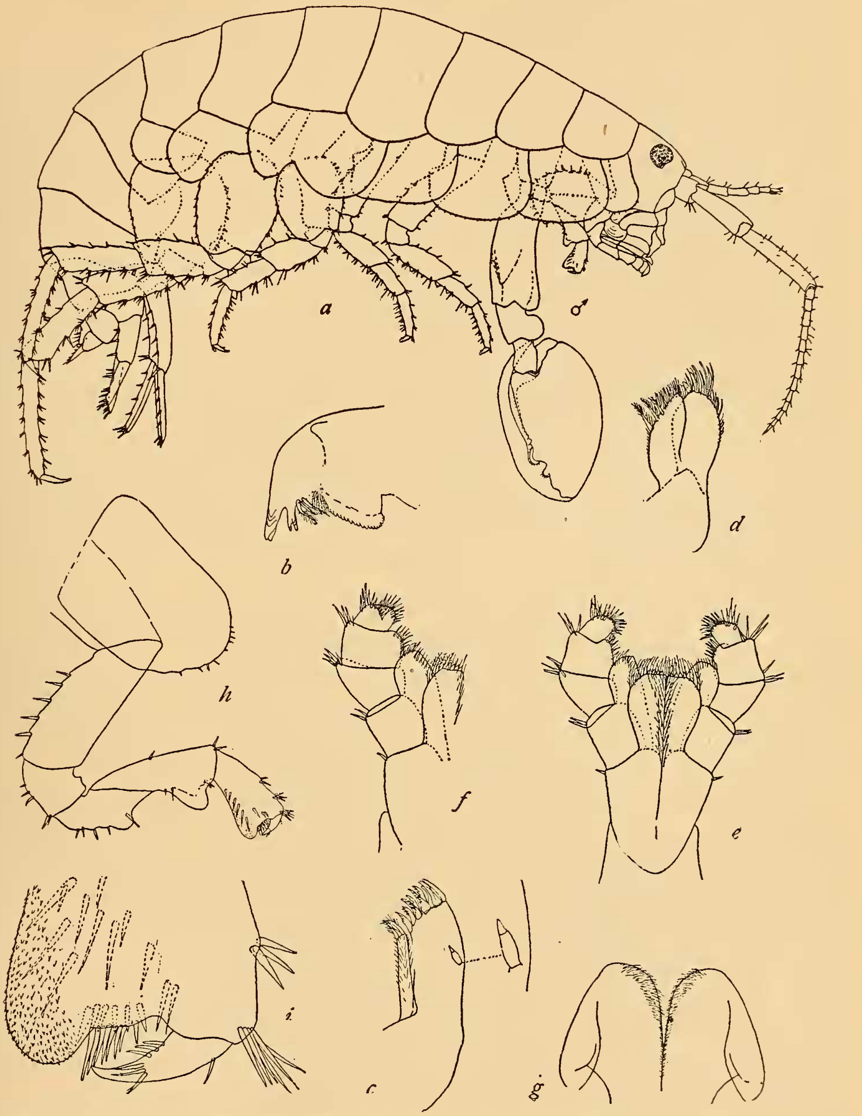

Fig. 1.—*Orchestia uhleri*, new species. Male, *a*, Entire animal. *b*, Right mandible. *c*, Maxilla 1. *d*, Maxilla 2. *e*, Maxillipeds. *f*, Maxilliped with palp flattened out to show entire width of joints. *g*, Lower lip. *h*, Gnathopod 1. *i*, End of sixth joint and seventh joint of gnathopod 2, enlarged.

long as sixth, produced at the lower anterior corner into a rounding lobe, third joint produced anteriorly into a prominent rounding lobe, sixth joint over half as wide as long, narrowing distally, with upper margin convex, and the entire lower margin which is about straight forming the palm, two rounding protuberances on palm adjacent to the hinge of seventh joint, palm armed on distal two-thirds with short spines which are more thickly clustered on the protuberances, seventh joint very long and curving inward toward the end, greatly overlapping palm and when closed against palm the apex extending nearly to the upper margin of fourth joint, a large tooth or protuberance on inner surface fitting between those of the palm. Peraeopods 1 and 2 about normal except that the seventh joints are rather small. Peraeopods 3 to 5 increasing consecutively in length and having all joints normally expanded. Uropod 1 projecting farther backward than uropod 2 which projects considerably farther than uropod 3. Uropod 1 with peduncle slightly longer than the rami which are very nearly equal in length. Uropod 2 with peduncle equal in length to outer ramus which is a little shorter than the inner. Uropod 3 with peduncle and ramus nearly equal in length, ramus about three times longer than wide, bearing four long spines on outer margin and a cluster of three spines on apex. Telson a little longer than wide, with the slightly concave sides converging toward the apex which is divided into two shallow lobes by a slight central notch, two long spines on each lateral margin, two extending backward from each lobe, and two shorter spines on upper surface near apex.

Length.—Male, 14.5 mm.; *female,* smaller.

Gnathopod 1 of the female is very distinctly subchelate, the palm being slightly oblique and armed near the defining angle with a row of five or six long slender spines, and the seventh joint bearing near its apex several setae and on inside margin two short blunt spines. Gnathopod 2 of female with second joint moderately expanded, sixth joint produced considerably beyond the very short seventh joint into an evenly rounded soft tumid lobe.

Although the genus *Orchestia* is mostly confined to marine beaches, a number of its members, in widely separated parts of the earth, are known to occur in moist earth and amongst decaying vegetation, at considerable distances from the coast and at times at elevations of 2000 to 3000 feet. Fritz Müller described a species (*O. darwinii*) from Brazil, of which he says, "The animal lives in marshy places in the vicinity of the sea, under decaying leaves, in the loose earth which the marsh crabs throw up around the entrance to their burrows, and even under dry cow dung and horse dung. If this species removes to a greater distance from the shore than the majority of its congeners, its male differs still more from all known species by the powerful chelae of the second pair of feet." The present record, I believe, is the first of the occurrence of this genus in North America at any locality removed from the coast, Lake Monroe being twenty miles from the nearest point on the east coast of Florida and about 120 miles from the sea by way of the St. Johns River.